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Deep Sea Red Crab

by

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Distribution, Biology and Management

Deep sea red crabs (*Chaceon quinquedens*, for the five spines on the carapace, formerly *Geryon quinquedens*) are distributed on and along the edge of the continental shelf of the Northwest Atlantic Ocean and in the Gulf of Maine and the Gulf of Mexico. They inhabit mud, sand, and hard bottom at depths from 200 to 1800+ meters, at water temperatures between 5-8° C (Wigley et al. 1975). In the Gulf of Maine, red crabs are found in waters as shallow as 75 m. Male red crabs are believed to require 5-6 years to attain commercial size, and more than 15 years to reach a maximum size of about 180 mm carapace width (Haefner 1977). Female red crabs only grow to a maximum size of about 120 mm. During mating, the larger male crab forms a protective “cage” around the female, carrying her until she molts and becomes ready to copulate. Female deep sea red crabs brood their eggs under their abdominal flap for up to nine months. After the larvae hatch, they remain in the plankton for 23-125 days. Larval settlement is believed to occur near the base of the continental slope, and the young crabs move up the slope as they mature. Male and juvenile crabs are commonly found in deeper water than females.

In 2002, the New England Fishery Management Council implemented the Deep Sea Red Crab Fishery Management Plan. Under the plan, a limited access fishery was implemented with the fishery authorized to operate with a target TAC of 2688 mt (5.928 million pounds), a 780 days-at-sea allocation, and a trip limit of 34 mt (75,000 pounds). As well, only male crabs are allowed to be landed. There are 5 boats currently participating in the fishery. Red crab fishing occurs year round along the shelf edge from the southern edge of Georges Bank south to Cape Hatteras using square and conical pots as the principal gear (Figure 37.1). The red crab population in US north Atlantic waters between Georges Bank and Cape Hatteras is managed as a single stock.

The Fishery

Annual US commercial landings of deep sea red crab during 1982 to 2005 ranged from 466 mt (1996) to 4,000 mt (2001); no fishery occurred in 1994. Since 2002 when the fishery

management plan was implemented, landings have been stable at about 2000 mt per year (Table 37.1, Figure 37.2). A small portion of red crab landings are taken as bycatch in the offshore lobster fishery. There is no recreational fishery.

Discards consist of female crabs (which cannot be landed by regulation) and male crabs too small to sell (current fishery selectivity curves indicate that 50% of red crabs are fully available to the fishery by 92 mm carapace width). Discards have not been well quantified but are likely substantial for both males and females in the red crab fishery. Mortality rates for discarded red crabs are unknown.

Research Vessel Surveys

The NEFSC winter, spring and fall bottom trawl surveys cover only the inner edge of the deep sea red crab's depth range (200m+), so few red crabs are caught and a meaningful numerical index of abundance cannot be calculated.

The main sources of fishery-independent data for red crab have been two camera/trawl surveys designed specifically for red crabs and operating completely within the species' depth range. The first targeted survey was conducted in 1974 using sled-mounted camera gear to count the crabs on the bottom and an otter trawl to catch, measure and sex the crabs (Wigley et al. 1975). A second survey, using comparable gear, was conducted between 2003 and 2005 as a cooperative research project led by industry-scientist partners. The recent survey, conducted to assess changes in the red crab population since 1974, indicated that both abundance and size structure of the population had changed over time. Small crabs were relatively abundant during 2003-2005, but the average size of male crabs was smaller than in 1974 while the average size of females was the same (Figure 37.3). Overall red crab biomass is estimated to have increased since 1974, most likely because of a larger numbers of small crabs. Despite the overall increase in crab abundance, the biomass of large males (114mm+) is currently lower than in 1974, most likely as a result of fishery removals.

Assessment Results

Results from the 2003-2005 survey served as the basis for the 2006 deep sea red crab stock assessment. Fishable biomass of male deep-sea red crab was estimated from this survey to be (+1SE) $36,250 \pm 5,460$ mt (80 million pounds). Fishable biomass in the 1974 survey was estimated to be about 34,000 mt (76 million pounds). However, the current fishery harvests smaller red crabs (70-114mm CW) than in 1974 (114mm+).

The estimated biomass of mature female red crabs (70+ mm carapace width) from the 2003-2005 survey was 67,900 mt (149.7 million lbs), compared to an estimate of 19,700 mt (43.4 million lbs) from the 1974 survey. Mature male biomass (75+ mm) was estimated to be 47,800 mt (105.4 million lbs) during 2003-2005 vs. 37,200 mt (82.0 million lbs) in 1974.

Based on the ratio of landings to fishable biomass (males only), the average fishing mortality rate for deep sea red crab during 2003-2005 was estimated to be 0.055 ± 0.008 y⁻¹. This estimate does not include any discard mortality of undersized male or female crabs. If a significant number of

red crabs do not survive the discard process, then the actual F will be much higher.

Biological Reference Points

No reliable biological reference points are available for assessing the deep sea red crab resource as so little is known about growth, natural mortality, longevity and other vital stock parameters. An assessment conducted in 1977 (Serchuk 1977) estimated MSY for deep sea red crabs (males only) at $1/2 M B_o = 2,494$ mt (5.5 million lbs.) assuming natural mortality $M=0.2 \text{ y}^{-1}$, minimum market size was 4.5 inches (114 mm), and the estimate of biomass from the 1974 survey represented virgin biomass (B_o). The 2002 FMP includes a preferred MSY estimate of 2,830 mt (6.24 million lbs) calculated using the same model as Serchuk (1977) but assuming a natural mortality $M=0.15$, a minimum market size of 4 inches (101mm) and an expanded fishing area. Due to uncertainty about the biological parameters mentioned above and the model used to calculate MSY, none of the MSY estimates are now considered to be reliable.

Summary

Commercial landings of deep sea red crab have been stable at about 2,000 mt/yr since the FMP was implemented in 2002. Fishable male biomass was estimated to be 36,300 mt in 2003-2005. As no reliable estimate of MSY or F_{msy} exist, the status of the red crab resource with respect to overfishing or being overfished is unknown.

Table 37.1 Recreational and commercial landings of deep sea red crab (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	1.75	0.47	1.73	1.50	1.87	3.13	4.00	2.14	1.92	2.04	2.01
Canada	-	0.62	0.31	0.03	0.03	0.06	0.13	0.07	0.08	0.05	0.04
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	1.75	1.09	2.04	1.53	1.90	3.19	4.13	2.21	2.00	2.09	2.05

For further information

Elner, R. W., S. Koshio, and G. V. Hurley. 1987. Mating behavior of the deep-sea red crab, *Geryon quinquedens*, Smith (Decapoda, Brachyura, Geryonidae). *Crustaceana* 52(2):194-201.

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- Wigley, R. L., R. B. Theroux, and H. E. Murray. 1975. Deep-sea red crab, *Geryon quinquedens*, survey off northeastern United States. *Marine Fisheries Review* 37:1-21.

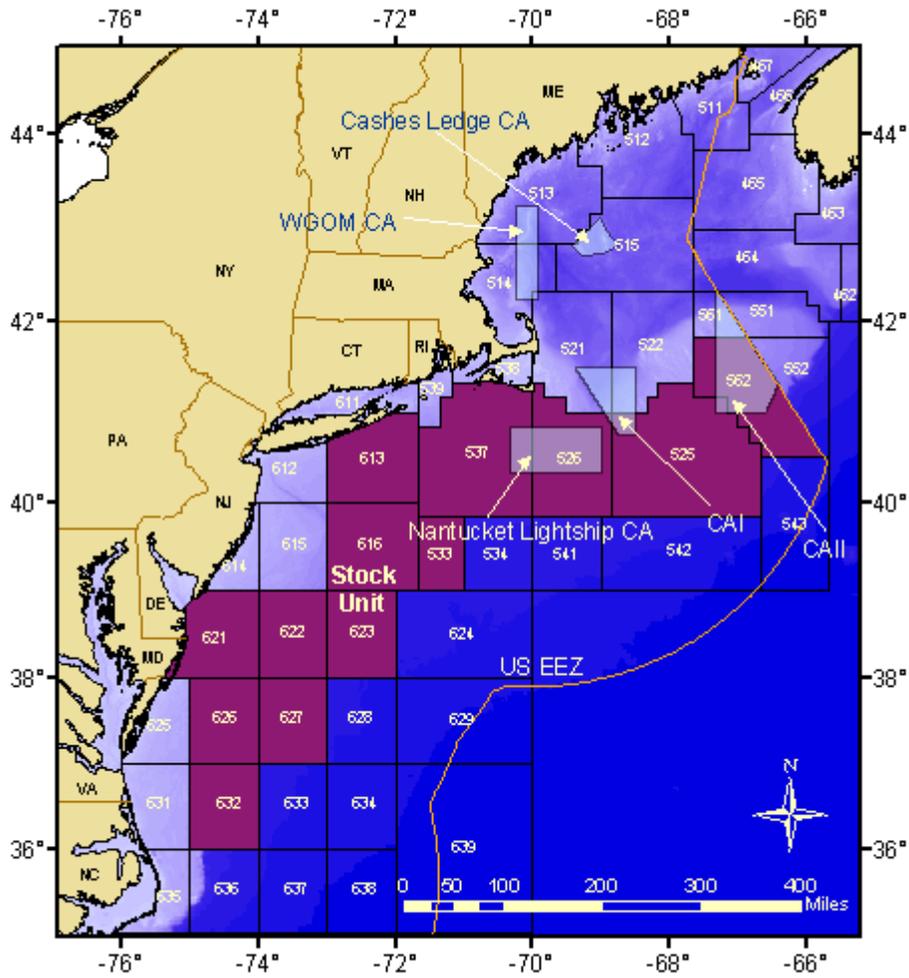


Figure 37.1. Statistical areas used to define the deep sea red crab stock.

US Landings of Deep Sea Red Crab (*Chaceon quinquegens*)

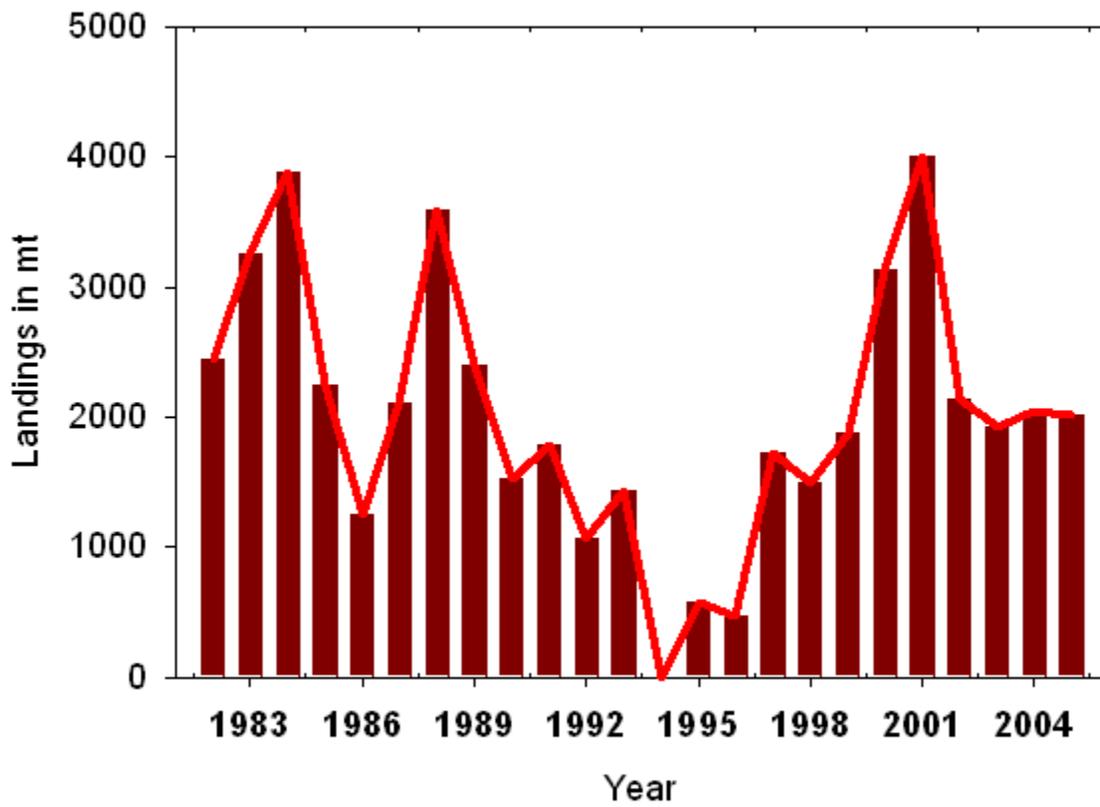


Figure 37.2 US landings of deep sea red crab. No targeted fishing took place in 1994.

Deep Sea Red Crab (*Chaceon quinque-dens*)
Size Frequencies From Targeted Surveys
in 1974 and in 2003-2005

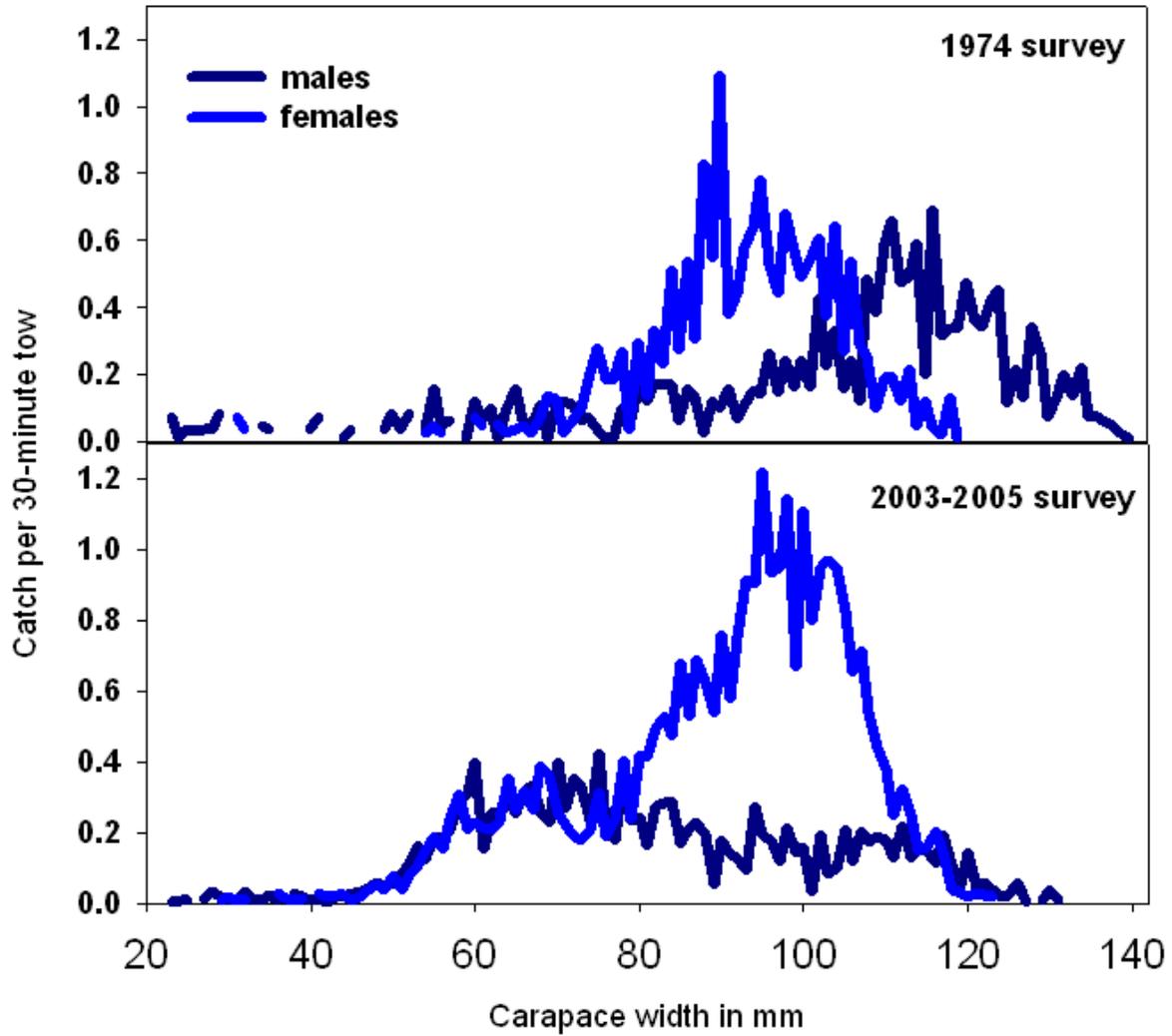


Figure 37.3. Size frequencies of deep sea red crabs from two targeted surveys that took place thirty years apart.